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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,202	10/24/2003	Sia Kim Tan	CS02-099	2334
30402	7590	05/17/2006	EXAMINER	
WILLIAM STOFFEL			CHACKO DAVIS, DABORAH	
PMB 455			ART UNIT	
1735 MARKET ST. - STE. A			PAPER NUMBER	
PHILADELPHIA, PA 19103-7502			1756	

DATE MAILED: 05/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/693,202

Applicant(s)

TAN ET AL.

Examiner

Daborah Chacko-Davis

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 12-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 5-6, and 12-20, are rejected under 35 U.S.C. 102(b) as being anticipated by U. S. Patent No. 5,936,707 (Nguyen et al., hereinafter referred to as Nguyen).

Nguyen, in the abstract, in col 4, lines 6-67, in col 5, lines 1-26, in col 6, lines 45-67, in col 7, lines 1-10, in col 8, lines 4-48, in col 13, lines 33-38, figures 2-6, discloses a method of forming a multi-level photoresist profile on a substrate comprising exposing the photoresist layer of a predetermined thickness on a substrate to light through a multi-level reticle (see figure 5), said reticle comprises a partially transmitting film of at least 30% transmission, and phase shift of 180 degrees, an opaque film (third transmission level film) overlying a portion of the partially transmitting film that transmits a first transmitted light of a first dosage (first intensity) to the first photoresist area (reference 104, of figure 13, corresponds to the claimed third photoresist area to a third dosage); a second transmitted light of a second intensity transmitted through the partial transmitting film of the reticle to a second photoresist area (see reference 106 of figure 13), and a third transmitted light of a third intensity transmitted through the transparent portion of the reticle (first transmission level film, transparent quartz substrate) to a third

photoresist area (reference 108, of figure 13, corresponds to the claimed first photoresist area to a first dosage to form an opening in the photoresist), developing the photoresist to form a photoresist profile comprising a photoresist area of a first thickness (reference 106) less than the predetermined thickness and corresponding to the second photoresist area, forming a photoresist area of a second thickness (reference 104) greater than the first thickness (reference 106) and corresponding to the first photoresist area (since substantially all the light is blocked by the opaque film), and forming a third thickness in the photoresist film (reference 108, of substantially zero thickness, an opening) corresponding to the third photoresist area, resulting in a photoresist profile of at least two thicknesses and an opening (claims 1, 12-13, and 15-20). Nguyen, in col 2, lines 66-67, in col 4, lines 35-38, discloses that dual damascene structure can be formed in the dielectric under layer in a single etching step such that the dielectric material under layer is etched at the same rate as the overlying multi-level photoresist (claim 5). Nguyen, in col 4, lines 35-38, discloses that the substrate is an integrated circuit substrate (claim 6). Nguyen, in col 7, lines 12-16, discloses that the opaque film is chromium or chromium oxide (claim 14).

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2-4, 7-10, and 21, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al., hereinafter referred to as Nguyen) in view of U. S. Patent No. 6,482,554 (Matsunuma).

Nguyen, is disclosed in paragraph no. 2.

Nguyen, in col 2, lines 66-67, in col 4, lines 35-38, in col 6, lines 58-65, discloses that dual damascene structure (pattern) can be formed in the dielectric under layer (surface of the substrate) in a single etching step such that the dielectric material under layer (or substrate) is etched at the same rate as the overlying multi-level photoresist.

The difference between the claims and Nguyen is that Nguyen does not disclose that the photoresist layer (light sensitive photoresist film) is comprised of a lower photoresist layer and an upper photoresist layer, and that the lower photoresist layer is less sensitive to light than the upper photoresist layer between about 5 and 10% (claims 2-3, 7, 9-10, 21). Nguyen does not disclose that the upper and lower layers of photoresist are of a positive or negative type (claim 4). Nguyen does not disclose that the sensitivity of the lower photoresist layer and the upper photoresist layer is adjusted such that the first intensity of light through the transparent portion of the substrate sensitizes both the upper and lower photoresist layers, and the second intensity of light through the transparent substrate sensitizes only the upper photoresist layer, and the third intensity of light through the opaque film does not sensitize either the upper or lower photoresist layers (claim 8).

Matsunuma, in col 3, lines 29-60, in col 4, lines 5-44, discloses that the photoresist layer comprises a first photoresist film of low sensitivity and a second

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photoresist film, formed on the first photoresist film, of high sensitivity greater than that of the first photoresist film; and that the sensitivity of the first photoresist film is adjusted such that the first photoresist film and the second photoresist film is completely exposed through the first transmittance part (transparent portion of the mask substrate), the second intensity of light from the second transmittance part only sensitizes the second photoresist film and not the lower sensitive first photoresist film, and the third intensity of light of the third transmittance part (opaque region) does not sensitize neither the first photoresist film nor the second photoresist film.

Therefore, it would be obvious to a skilled artisan to modify Nguyen by employing the method of using two layers of photoresist as suggested by Matsunuma because Matsunuma, in col 5, lines 45-51, discloses that the dual layers of photoresist can be replaced with a thick single layer of photoresist, and vice versa, and Matsunuma, in col 6, lines 5-7, discloses that using a first photoresist film and a second photoresist film of differing sensitivities makes it possible to accurately control the film thickness.

### ***Response to Arguments***

5. Applicant's arguments filed February 21, 2006, have been fully considered but they are not persuasive. The 102 and 103 rejections made in the previous office action are maintained.

A) Applicants argue that Nguyen does not disclose a partial transmitting phase shift film with a phase shift of about  $180^\circ$ .

Nguyen, in col 4, lines 24-43, discloses using a half-tone film that transmits light with a phase shift of about 180°.

B) Applicants argue that Nguyen does not disclose that the photoresist layer and the dielectric layer have the same etch rate.

Nguyen, in col 6, lines 58-64, and in figures 4-5, discloses an etch step wherein the photoresist film pattern 62, and the dielectric film 54 are etched during the second etch (one etch rate, removed exposed portions of the dielectric at 63, and photoresist pattern 62, i.e., both resist and dielectric material has the same etch rate) resulting in the etching of the photoresist pattern (completely removed) 62, and corresponding removal of the exposed dielectric material (exposed portion, reference 63), resulting in the structure of figure 5, i.e., the masked portion of the dielectric was not etched at the second etch.

C) Applicants argue that Matsunuma does not teach phase or phase-shift.

Matsunuma is not depended upon to teach phase shift. Nguyen is depended upon to disclose phase-shift.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcd

May 5, 2006.



**JOHN A. MCPHERSON**  
**PRIMARY EXAMINER**